



CRYOPUMP PRODUCT CATALOGUE

Sumitomo Heavy Industries, Ltd. (SHI) has a tradition of excellence and innovation that spans over 400 years. From its very beginning as a small shop selling medicines and books in Kyoto, Japan in the early 17th century, to its current status as a diverse, \$6 billion corporation, SHI has continued to grow and flourish in an ever-changing international market.

SHI's acquisition of IGC-APD Cryogenics, Inc. in 2002 brought together two of the world's leading cryogenic companies to form the SHI Cryogenics Group, with an unsurpassed tradition of design, development and success in the manufacture of cryogenic equipment.

SHI Cryopumps continue this tradition by supporting both global research & development as well as state-of-the-art technologies. Today, applications of cryogenic technologies can be found in our daily lives. SHI Cryopumps are used directly or in the manufacturing of many of the world's semiconductor, telecommunications, electronics, vacuum-coated, and custom laboratory equipment and products.

SHI offers a wide range of Cryopump products. Marathon® CP Series Cryopumps are offered with standard and low profile enclosures, several flange options and manual and automatic features. They can be serviced in-situ without breaking vacuum or removing the pump from the chamber. The SICERA® Cryopump uses SHI proprietary inverter technology to reduce customer energy costs. The resulting savings and increased production efficiency make SICERA® ideal for semiconductor-related manufacturing.

SHI Cryopumps are built in world-class manufacturing facilities using Six Sigma manufacturing processes and process capabilities and analysis. The result is a product portfolio that offers flexibility, high reliability and is supported by a global sales, service and support network.

CRYOPUMP PRODUCT SPECIFICATION

Cryopump Model	Marathon® CP						SICERA®	
	CP-8	CP-8LP	CP-250LP	CP-12	CP-16	CP-20	KZ-8L	KZ-12L
Air (liters/second)	1,500	1,800	3,000	3,600	4,800	9,700	1,500	3,300
Water (liters/second)	4,200	4,200	6,300	9,560	17,300	29,100	4,000	9,500
Argon (liters/second)	1,250	1,500	2,500	3,100	4,100	8,300	1,200	3,500
Hydrogen (liters/second)	2,300	3,000	5,000	7,300	12,000	14,000	2,200	5,500
Argon Throughput (torr liters/second)	11.0	11.0	11.0	12.6	11.4	11.3	8.8	11.3
Argon Capacity (standard liters)	1,200	1,600	1,600	2,000	5,500	6,000	1,000	2,000
Hydrogen Capacity (standard liters)	25	23	30	50	50	33	12	35
Crossover Rating (torr-liters)	220	220	300	650	500	400	150	150
Weight	35 lbs. (16.8 kg)	39.5 lbs. (17.9 kg)	44 lbs. (20 kg)	90 lbs. (41 kg)	110 lbs. (50 kg)	170 lbs. (77 kg)	70.6 lbs. (32 kg)	88.2 lbs. (40 kg)
Zephyr®	●	●	●					
HC-4E1	●	●	●					
HC-8E4	●	●	●	●	●			
F-70	●	●	●	●	●	●		
CSW-61C/D							●	●

APPLICATIONS

SHI's Cryopump systems are specifically designed to meet the needs of high vacuum processes, and are used in the manufacture of a variety of products. Typical applications for cryopumps include:



SHI & APD CRYOGENICS: A HISTORY

Masatomo Sumitomo, founder of the Sumitomo family, opens a shop dealing in medicines and books in Kyoto, Japan

**17th
Century**

Discovery of Besshi Copper Mine—Sumitomo receives exclusive mining rights

1690

Precursor to Sumitomo Heavy Industries, Ltd. established as a machinery production and repair facility at the Besshi Mine Plant

1888

Establishment of Sumitomo Machinery Works, Ltd.

1934

Sumitomo establishes its cryogenics business at the Hiratsuka Research Laboratory in Hiratsuka City, near Tokyo.

1959

Precursor to APD Cryogenics established as Space and Missile Department of Air Products in Allentown, Pennsylvania, USA

1962

Renamed the Advanced Product Development Department of Air Products

1968

Introduces Displex® cryocooler systems

Merger between Sumitomo Machinery and Uruga Heavy Industries results in the establishment of Sumitomo Heavy Industries, Ltd.

1969

1976

Pioneers current generation cryopump technology

1982

Merger with Nittoku Metal Industries results in the establishment of the Precision Business Division, which today includes the Cryogenics Group

1987

Becomes a subsidiary of Intermagnetics General Corporation

2002

Becomes a subsidiary of Sumitomo Heavy Industries, Ltd.

MARATHON® CP-8 CRYOPUMP



Available Configurations

- ANSI 6", ISO 200 or CF 10" Flange Options
- Standard Manual Operation
- Optional Fully-Automated Operation with Marathon® Cryopump Controller
- Two (2) cryopumps operating with one (1) HC-8E4 or F-70L/H Compressor
- Displex® Technology

Standard Scope of Supply

- CP-8 Cryopump
- Zephyr®, HC-4E1, HC-8E4 or F-70L/H Compressor
- 10' Flexible Gas Lines
- 10' Cold Head Cable
- Tool Kit

Performance Specifications

Air liters/second	1,500
Water liters/second	4,200
Argon liters/second	1,250
Hydrogen liters/second	2,300
Argon Throughput torr liters/second	11.0
Argon Capacity standard liters	1,200
Hydrogen Capacity standard liters	25
Crossover Rating torr-liters	220
Cooldown Time Minutes	75
Weight kg (lbs.)	16.8 (35)
Dimensions (H) mm (in.)	516 (20.3)
Maintenance Hours	13,000

MARATHON® CP-8LP CRYOPUMP



Available Configurations

- Standard Low Profile Design in Left or Right Hand Configurations
- ANSI 6", ISO 200 or CF 10" Flange Options
- Standard Manual Operation
- Optional Fully-Automated Operation with Marathon® Cryopump Controller
- Two (2) cryopumps operating with one (1) HC-8E4 or F-70L/H Compressor
- Displex® Technology

Standard Scope of Supply

- CP-8LP Cryopump
- Zephyr®, HC-4E1, HC-8E4 or F-70L/H Compressor
- 10' Flexible Gas Lines
- 10' Cold Head Cable
- Tool Kit

Performance Specifications

Air liters/second	1,800
Water liters/second	4,200
Argon liters/second	1,500
Hydrogen liters/second	3,000
Argon Throughput torr liters/second	11.0
Argon Capacity standard liters	1,600
Hydrogen Capacity standard liters	23
Crossover Rating torr-liters	220
Cooldown Time Minutes	110
Weight kg (lbs.)	17.9 (39.5)
Dimensions (HxL) mm (in.)	186 x 565 (7.3 x 22.3)
Maintenance Hours	13,000

MARATHON® CP-250LP CRYOPUMP



Available Configurations

- Standard Low Profile Design in Left or Right Hand Configurations
- ISO 250 Flange
- Standard Manual Operation
- Optional Fully-Automated Operation with Marathon® Cryopump Controller
- Two (2) cryopumps operating with one (1) HC-8E4 or F-70L/H Compressor
- Displex® Technology

Standard Scope of Supply

- CP-250LP Cryopump
- Zephyr®, HC-4E1, HC-8E4 or F-70L/H Compressor
- 10' Flexible Gas Lines
- 10' Cold Head Cable
- Tool Kit

Performance Specifications

Air liters/second	3,000
Water liters/second	6,300
Argon liters/second	2,500
Hydrogen liters/second	5,000
Argon Throughput torr liters/second	11.0
Argon Capacity standard liters	1,600
Hydrogen Capacity standard liters	30
Crossover Rating torr-liters	300
Cooldown Time Minutes	110
Weight kg (lbs.)	20 (44)
Dimensions (HxL) mm (in.)	181 x 591 (7.2 x 23.2)
Maintenance Hours	13,000

MARATHON® CP-12 CRYOPUMP



Available Configurations

- ANSI 10", ISO 320 or CF 14" Flange Options
- Standard Manual Operation
- Optional Fully-Automated Operation with Marathon® Cryopump Controller
- Displex® and Whisper® Technology

Standard Scope of Supply

- CP-12 Cryopump
- HC-8E4 or F-70L/H Compressor
- 10' Flexible Gas Lines
- 10' Cold Head Cable
- Tool Kit

Performance Specifications

Air liters/second	3,600
Water liters/second	9,560
Argon liters/second	3,100
Hydrogen liters/second	7,300
Argon Throughput torr liters/second	12.6
Argon Capacity standard liters	2,000
Hydrogen Capacity standard liters	50
Crossover Rating torr-liters	650
Cooldown Time Minutes	90
Weight kg (lbs.)	41 (90)
Dimensions (H) mm (in.)	600 (23.5)
Maintenance Hours	13,000

MARATHON® CP-16 CRYOPUMP



Available Configurations

- ISO 400, CVC 10" or Wire Seal Flange Options
- Standard Manual Operation
- Optional Fully-Automated Operation with Marathon® Cryopump Controller
- Displex® and Whisper® Technology

Standard Scope of Supply

- CP-16 Cryopump
- HC-8E4 or F-70L/H Compressor
- 10' Flexible Gas Lines
- 10' Cold Head Cable
- Tool Kit

Performance Specifications

Air liters/second	4,800
Water liters/second	17,300
Argon liters/second	4,100
Hydrogen liters/second	12,000
Argon Throughput torr liters/second	11.4
Argon Capacity standard liters	5,500
Hydrogen Capacity standard liters	50
Crossover Rating torr-liters	500
Cooldown Time Minutes	135
Weight kg (lbs.)	50 (110)
Dimensions (H) mm (in.)	633 (24.9)
Maintenance Hours	13,000

MARATHON® CP-20 CRYOPUMP



Available Configurations

- ISO 500, ANSI 20" or Wire Seal Flange Options
- Standard Manual Operation
- Optional Fully-Automated Operation with Marathon® Cryopump Controller
- Displex® and Whisper® Technology

Standard Scope of Supply

- CP-20 Cryopump
- F-70L/H Compressor
- 10' Flexible Gas Lines
- 10' Cold Head Cable
- Tool Kit

Performance Specifications

Air liters/second	9,700
Water liters/second	29,100
Argon liters/second	8,300
Hydrogen liters/second	14,000
Argon Throughput torr liters/second	11.3
Argon Capacity standard liters	6,000
Hydrogen Capacity standard liters	33
Crossover Rating torr-liters	400
Cooldown Time Minutes	190
Weight kg (lbs.)	77 (170)
Dimensions (H) mm (in.)	569 (22.4)
Maintenance Hours	13,000

SICERA® KZ-8L CRYOPUMP

Available Configurations

- ICF 253 mm Flange
- Standard Fully-Automated Operation
- SHI Proprietary Inverter Technology

Standard Scope of Supply

- KZ-8L Cryopump
- CSW-61C/D Compressor
- Remote Cryopump Controller with RS-485 Cables
- Flexible Gas Lines
- Power Cables



Performance Specifications

Air liters/second	1,500
Water liters/second	4,000
Argon liters/second	1,200
Hydrogen liters/second	2,200
Argon Throughput torr liters/second	8.8
Argon Capacity standard liters	1,000
Hydrogen Capacity standard liters	12
Crossover Rating torr-liters	150
Cooldown Time Minutes	70
Weight kg (lbs.)	32 (70.6)
Dimensions (HxWxD) mm (in.)	230 x 415 x 615 9.1 x 16.3 x 24.2
Maintenance Hours	12,000

SICERA® KZ-12L CRYOPUMP

Available Configurations

- ANSI 10" Flange
- Standard Fully-Automated Operation
- SHI Proprietary Inverter Technology

Standard Scope of Supply

- KZ-12L Cryopump
- CSW-61C/D Compressor
- Remote Cryopump Controller with RS-485 Cables
- Flexible Gas Lines
- Power Cables



Performance Specifications

Air liters/second	3,300
Water liters/second	9,500
Argon liters/second	3,500
Hydrogen liters/second	5,500
Argon Throughput torr liters/second	11.3
Argon Capacity standard liters	2,000
Hydrogen Capacity standard liters	35
Crossover Rating torr-liters	150
Cooldown Time Minutes	100
Weight kg (lbs.)	40 (88.2)
Dimensions (HxWxD) mm (in.)	230 x 518 x 689 9.1 x 20.4 x 27.1
Maintenance Hours	12,000

COMPRESSOR OPTIONS

Both the Marathon® CP and SICERA® Cryopump lines are driven by highly-efficient and reliable helium compressors. These compressors boast an industry-leading 30,000 hour maintenance interval, and are available in single-phase and three-phase, low and high voltage, and water and air-cooled versions.

The Zephyr®, HC-4E1, HC-8E4 and F-70 Compressors are designed for use with the Marathon® CP line, while the CSW-61C and CSW-61D were specifically designed for SICERA® systems.

Zephyr® Air-Cooled Compressor



Electrical Supply	1 Phase 200 V, 220 V, 230/240 V, 50 Hz 220 V, 60 Hz
Power Consumption	3.0 kW at 50 Hz 3.4 kW at 60 Hz
Ambient Temperature	4-32 °C (40-90 °F)
Cooling Air	20 m³/min (706 cfm)
Dimensions (HxWxD)	715 x 453 x 488 mm (28.2 x 17.8 x 19.2 in.)
Weight	102 kg (225 lbs.) 111 kg (245 lbs.) w/ transformer
Maintenance	30,000 Hours

HC-4E1 Water-Cooled Compressor



Electrical Supply	1 Phase 200 V, 230/240 V, 50 Hz 208/230 V, 60 Hz
Power Consumption	2.6 kW at 50 Hz 3.0 kW at 60 Hz
Ambient Temperature	4-40 °C (40-104 °F)
Cooling Water (Inlet)	2.7 L/min. (0.7 gal./min.) 4-27 °C (40-80 °F)
Dimensions (HxWxD)	504 x 430 x 485 mm (19.8 x 16.9 x 19.1 in.)
Weight	75 kg (165 lbs.) 82 kg (180 lbs.) w/ transformer
Maintenance	30,000 Hours

HC-8E4 Water-Cooled Compressor



Electrical Supply	3 Phase 220 V, 50 Hz 220/230 V, 60 Hz
Power Consumption	3.7 kW at 50 Hz 4.3 kW at 60 Hz
Ambient Temperature	4-40 °C (40-104 °F)
Cooling Water (Inlet)	5.7-9.5 L/min. (1.5-2.5 gal./min.) 4-21 °C (40-70 °F)
Dimensions (HxWxD)	504 x 430 x 485 mm (19.8 x 16.9 x 19.1 in.)
Weight	75 kg (165 lbs.)
Maintenance	30,000 Hours

F-70L/H Water-Cooled Compressor



	F-70L	F-70H
Electrical Supply	3 Phase 200 V, 50/60 Hz	3 Phase 380-415 V, 50 Hz 480 V, 60 Hz
Power Consumption	6.6-6.9 kW at 50 Hz 7.5-7.8 kW at 60 Hz	
Ambient Temperature	4-40 °C (40-104 °F)	
Cooling Water (Inlet)	6-9 L/min. (1.6-2.4 gal./min.) 5-25 °C (41-77 °F)	
Dimensions (HxWxD)	532 x 443 x 493 mm (20.9 x 17.4 x 19.4 in.)	
Weight	100 kg (225 lbs.)	
Maintenance	30,000 Hours	

CSW-61C/D Water-Cooled Compressor



	CSW-61C	CSW-61D
Electrical Supply	3 Phase 200-230 V, 50/60 Hz	3 Phase 378-528 V, 50/60 Hz
Power Consumption	0.9 kW/pump (KZ-8L) 1.5 kW/pump (KZ-12L)	
Ambient Temperature	5-35 °C (41-95 °F)	
Cooling Water (Inlet)	4-10 L/min. (1.1-2.6 gal./min.) 4-28 °C (40-82 °F)	
Dimensions (HxWxD)	865 x 455 x 660 mm (34.1 x 17.9 x 26.0 in.)	865 x 455 x 640 mm (34.1 x 17.9 x 25.2 in.)
Weight	130 kg (287 lbs.)	
Maintenance	30,000 Hours	

CRYOPUMP ACCESSORIES

Flexible & Superflex Gas Lines



SICERA® Cryopumps come equipped with flexible helium gas lines in 82 feet (25 meter) lengths, while Marathon® CP Cryopumps come standard with flexible helium gas lines in lengths from 10 feet (3 meters) to 66 feet (20 meters). Gas lines terminate in size 8 female coupling halves for quick connect and disconnect to/from the cold head and compressor and are also available with one end at 90°.

Optional Superflex lines offer superior flexibility and smaller bend radius without thinning the wall of the hose and offer a higher flexing cycle life than standard lines. Superflex lines also dampen vibration and noise of the helium gas traveling through the lines. All flexible gas lines are pre-charged with clean helium gas.

Cables



SHI offers a complete line of necessary interconnecting cables for our Marathon® CP Cryopump Systems. Standard, manual systems include cables that transmit the necessary power from our compressors to the cryopump cold head. Standard length is 10 feet (3 meters) with options to extend up to 66 feet (20 meters). For our fully automatic, MCC-driven systems, additional interconnecting cables are included to power the cold head, MCC, automatic valves, blanket heater and vacuum and temperature

instrumentation. RS-232 cables connect between our optional MCC and the customer's host computer, PLC or PC.

The SICERA® Cryopump system includes power cables for the pumps, compressors and controller. In addition, RS-485 cables connect the controller to both the pumps and compressors. SICERA™ system cables come in a variety of lengths and can be customized to fit the customer's process.

Tool Kits & Replacement Parts Kits



SHI offers a complete line of replacement parts kits that include all of the required parts and assemblies to completely recondition Marathon® CP Cryopumps and compressors.

Tool kits are available from the standard wrench kit (used for connecting couplings) that accompanies new Marathon CP® systems to more comprehensive kits that include such items as gas charging valves and additional tools required for performing your own service on Marathon® CP Cryopumps and compressors. Contact your local SHI office for details.

Marathon® Cryopump Controller (MCC)



SHI's MCC enables fully automatic operation of Marathon® CP Cryopumps. Industry standard cryopump protocol is delivered via RS-232 interface from the customer's host computer, PLC or Windows-based PC (using optional SHI MCS Software). Automatic operation and regeneration, as well as monitoring of critical system functions, are enabled, resulting in improved process times, enhanced efficiency of the user's process and greatly reduced downtime between production cycles. In conjunction with the MCC, Marathon® CP Cryopumps are enhanced with all necessary automatic valves, vacuum and temperature instrumentation and blanket heaters to enable safe and efficient automatic operation and regeneration.

Temperature Indicators



SHI offers Temperature Indicator Kits, designed to accurately display and/or communicate critical cryopump temperatures for our Marathon® CP Cryopumps. Model 1901 Indicator is a single, Model 9302 is dual, and Model 9304 is a four channel temperature indicator. All have alarm set points, RS-232 interface and analog output (optional on Model 1901). Model 9302 and 9304 Indicators additionally have a standard Ethernet interface. Temperature indicators provide the necessary excitation and accurate readout for our standard temperature diodes and kits come complete with 50 foot interconnecting cable(s).

SICERA® Remote Cryopump Controller



The SICERA® Remote Cryopump Controller enables fully automatic operation of SICERA® Cryopumps using commands from the end user's host computer and industry standard cryopump protocol. The controller comes standard with all SICERA® Cryopump systems. An Operation Panel Unit (shown in picture) is available as an option to monitor the status of the cryopumps and compressors, as well as to modify the regeneration sequence and to obtain key data from the cryopump system.

GLOBAL SERVICE & SUPPORT PROGRAMS

At SHI Cryogenics Group, we realize that our customers are diverse and the markets they serve are demanding and unique. In response, our global service and support network offers responsive and value-added support for our complete range of products. Our factory-trained technicians are located in strategic service centers around the globe and offer 24/7 on-call support, with no machines and no waiting.

Our cryopump service offerings are both flexible and cost effective, including:

- Product return to regional service depot for service, repair or complete refurbishment
- Technical assistance in diagnosing equipment issues via phone or e-mail
- Product exchange programs
 - Customer training programs
 - Customized service contracts

Additionally, Marathon® CP Cryopumps, can be serviced on-site, in-situ by the customer or a SHI factory-trained technician, without breaking vacuum or removing the cryopump from the chamber for return or replacement. This unique service option is the result of the high-quality, ultra-reliable Displex® Cryocooler technology found in all Marathon® CP Cryopumps. Displex® Cryocoolers have a long and successful operating history, and feature a pneumatic drive that optimizes performance, reliability and maintainability.

Performing in-situ service lowers the total cost of ownership by:

- Minimizing the required capital investment in spare parts
- Minimizing the “down time” of your system for service or repair
- Eliminating the cost of shipping a complete cryopump to a service center
- Eliminating labor costs associated with complete disassembly of the cryopump from your system

SICERA® Cryopumps can be returned to one of SHI’s service centers for routine maintenance, service or complete refurbishment. Additional SICERA® pumps and compressors are available as “exchange units.” Simply install the exchange unit and the returned unit will be refurbished and placed “on the shelf” ready for the next exchange.

Additionally, our factory-trained service technicians are available for on-site training, scheduled maintenance or emergency visits, offering rapid-response service for mission-critical applications.

Whether you have service performed by a qualified service technician, perform in-situ service yourself with readily-available spare parts, or participate in our exchange program, SHI Cryogenics Group can customize a service and support package to meet the needs of your organization. Contact your local SHI service center for more information.

ADDITIONAL PRODUCTS FROM SHI CRYOGENICS GROUP

In addition to the cryopumps featured in this catalogue, SHI Cryogenics Group designs and manufactures 4K and 10K G-M Cryocoolers, Pulse Tubes and other low temperature cooling technology.



SHI Cryogenics Group's 10K Gifford-McMahon Cryocoolers are versatile, orientation-free, closed-cycle systems that feature the same Displex® technology found in the complete line of Marathon® CP Cryopumps and MRI coolers, proven the world over with millions of reliable operating hours. They have been recognized as the industry standard since we developed the technology over 40 years ago. Our original pneumatic drive, which limits the number of wear parts in the refrigerator, combined with state-of-the-art design features, results in superior performance and low maintenance costs. Select models, such as the CH-208 (left), also feature Whisper® technology for quieter operation.

SHI's 10K Cryocoolers have proven reliability in thousands of applications, including MRI, cryopumping, research and other custom low-temperature applications.



SHI Cryogenics Group's 4K

Gifford-McMahon Cryocoolers are recognized as the most reliable and versatile systems available in the marketplace. These

Cryocoolers feature high cooling capacities, compact designs and are orientation-free. Models like the SRDK-408D2 (left) are the standard for MRI and other superconducting magnets and can be found cooling a wide variety of analytical and experimental devices and offer a very cost effective alternative to open-cycle liquid helium systems.

SHI's 4K Pulse Tube Cryocoolers embody leading-edge technology and provide low vibration, high reliability and low maintenance requirements. They are uniquely designed with no moving parts inside the coldhead. In addition, the SRP-062B (right) features an optional separated valve unit to further reduce vibration, enable operation in higher magnetic fields and ease maintenance requirements. SHI Pulse Tube Cryocoolers provide a stable low-temperature solution for sensitive measurement and analytical applications.

For additional literature and information regarding 10K Cryocooler, 4K G-M and Pulse Tube Cryocooler designs, please contact your local SHI Cryogenics Group sales office.





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